

Davis (Henry G.)

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PATHOLOGICAL BASIS
OF THE
Treatment of Joint Diseases.

BY HENRY G. DAVIS, M.D.

HALL, CLAYTON & MEDOLE, Printers, 46 Pine Street, N. Y.

[From the AMERICAN MEDICAL MONTHLY for November, 1862.]

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BY HENRY G. DAVIS, M.D.

(Read before the New York Academy of Medicine.)

For many years my attention has been directed to the treatment of diseases of the joints, and I have been led gradually to adopt views differing materially from those generally received by the profession, in relation to the causes operating to destroy, not only the cartilages, but the bones upon which they rest.

This difference of opinion has produced a corresponding change of treatment of the diseases in and about the joints; and I might say that no further evidence is required of the correctness of the theory, than that afforded by the success of the treatment based upon it.

In investigating this subject, it has been difficult to procure from books direct evidence upon the point which it will be my endeavor to establish, for the reason, that those who have examined and reported cases, have not so recorded their observations as to give the desired information. Not recognizing the causes which are assigned in this paper as operating to produce the lesions discovered, they have given but a partial narration of the facts their examination would have revealed, had their attention been directed to the point under consideration.

To illustrate, cases of fracture of the neck of the femur are reported, that had been under treatment by the straight splint for months.

In the *post-mortem* reports, the state of all the articulations below that of the fracture are detailed, while that of the hip, the seat of the injury, is omitted.

Had the condition of the hip-joint been given in every instance of fracture of the neck of the femur treated by the straight splint, and the result of dissection recorded, together with the description of the other articulations of the injured limb, the array of facts would have been abundant. As it is, I have obtained two cases from the books, in which all the facts having a bearing upon my theory are fully detailed; facts that quite conclusively support the views I shall advance as accounting for the phenomena witnessed.

There are, however, a sufficient number of cases in point, in which the facts (so far as related) correspond with the two mentioned. In addition, several surgeons have kindly supplied me with further testimony, derived from their own observations; and what is gratifying, as well as encouraging, to an investigator in a new field, they have been disposed to acknowledge the correctness of the conclusions to which the facts have led me.

During the course of inflammatory processes in and about the joints, after they have advanced to a certain point, the joint becomes in a measure fixed, and not unfrequently so much so, as to resemble true ankylosis. The time necessary to produce this result varies according to the character of the structure inflamed.

Nature appears to establish this immobility of the parts as a remedial measure, and, so far, it is safe to follow her guidance. In order to do this understandingly, however, let us inquire what is her aim and intention in thus rendering the joint immovable. It undoubtedly is to protect the surfaces of the joint, (that come in contact in the natural movements of the limbs,) when diseased, from friction. The pain which friction causes prompts the sufferer to second this intention of nature by his voluntary efforts. So far as this object can be accomplished by the muscles holding the joint motionless, they so act. Now, in effecting this immobility, are the muscles of the diseased joints relaxed, and therefore at rest; or, are they in a semi-contracted state, and thus fix the joint by acting equally upon every side of it? It would appear, from some facts I shall adduce, that the latter is their condition.

In inflammation in and about joints, when it has advanced to a degree that renders motion painful, if any attempt is made to flex or

extend the limb, the motion is communicated to the part beyond, in a similar manner as when the joint is ankylosed.

This immobility in some cases may be in part produced by the tumefaction accompanying the inflammatory process; but tumefaction is not necessary to the result, for in the very cases of chronic morbus coxarius where no swelling exists, the immobility is most marked. Anæsthesia has been produced in these cases without relieving the fixed state of the joints; yet that there was not true ankylosis, was proved by the perfect freedom of motion after a few days of treatment by elastic extension.

Again, in a limb with disease of the hip-joint that has been under treatment until it will admit of flexion and extension readily if moved gently, yet if handled a little roughly, all the muscles will be upon their guard, and the pelvis will be found following every motion of the femur.

If it is true that the diseased joint is held in a fixed position by a certain rigidity of the muscles passing to or beyond it, an amount of pressure corresponding to the contractile force of the muscles, as then exerted, must be produced upon the articulating surfaces of the joint. The inquiry may be made—Does not the joint in health sustain a much greater amount of pressure with impunity? To answer this question, let us examine a particular point in the mechanism of certain joints, of which the knee furnishes an example. The lower portion of the femur terminates in two condyles, each of which presents an articular surface, narrower, but at the same time more extensive, antero-posteriorly than the corresponding articular surface of the head of the tibia. Not the whole, therefore, but only a part of the articular surface of the condyle can be in contact with that of the tibia at any moment; and the precise portion in contact varies with every variation of flexion and extension of the knee-joint; this will be evident, when we consider that the concave surface of the head of the tibia and the convexity of the condyles of the femur do not correspond. When the limb is in exercise, or when its position can be frequently changed, no difficulty arises from the contact and pressure, because then the point of pressure is constantly changing, and when not in exercise, its position is altered whenever any inconvenience is experienced. In health, therefore, the pressure is never exerted upon any one point for a great length of time continuously, but is ever changing from one part of the whole surface to the other.

It is for this reason that a joint in health can suffer the weight of the body to rest upon it without injury; but when the parts are

fixated by disease or artificially, the pressure, whether it be a portion of the weight of the body, or only the contractile power of the muscles, (as exerted in fixing the joint,) falls entirely upon a small portion of each condyle, and a corresponding portion of the head of the tibia in contact with it. If it is admitted that only a small portion of the articular surfaces of the condyles and the tibia are in contact at any given time, in the normal condition, we are prepared for the inquiry, What will be the result of continual pressure, effected by the contractile force of the muscles while fixing the joint; a compression from which there may be no relief for weeks or months in succession?

The effect of continued, unremitting pressure upon other portions of the body is well understood.

Every practitioner cautions his pupils not to allow the heel to rest upon the bed while treating a case of fracture of the lower limb, warning him that, if he does so, the parts will slough; this result takes place, not because of the *severity* of the pressure, but from its *persistency*; from its not allowing, by change of position, the circulation, and consequently nutrition, to proceed uninterruptedly. The liability to this casualty increases the less sensibility there resides in the structure affected. It is also promoted by diminished vitality. We can hence easily understand why it so readily takes place in the heel. I would call attention to this fact, as I shall have occasion to notice the importance of its consideration when applied to the effect of pressure upon cartilages.

There are two reasons why diminished sensibility and nutritive endowment should render parts liable to destruction by pressure. First, the sensibility being slight, death of the parts occurs with very little suffering. Secondly, the vitality being low, less pressure is required to interrupt the vital functions, and thus cause death.

I trust that I shall be able to show conclusively, that in inflammations external to the capsules of the joints, sufficient to render them motionless, absorption, if not death, results to those portions of articular cartilage in contact and pressing upon each other; that this occurs when the external disease has not extended to the articular surfaces, and that it is owing chiefly, if not entirely, to continued pressure; this pressure being limited to that portion of the articulating surfaces that are held in contact for a period of time, without intermission or change, by the muscles which control the motions of the joint affecting the parts, precisely as pressure does when applied to the surface of the body, viz., producing absorption, when not sufficient entirely to arrest the nutrition of the parts, and when going be-

yond this point, death, with exfoliation of the parts pressed upon. For *this is precisely the result* we find in joints rendered immovable by artificial means. If this result follows from pressure in a previously healthy articulation, how much more destructive must be the process in a joint whose vitality is depressed by disease!

This view renders intelligible the *modus operandi* by which cartilages and bones, in some instances, are so rapidly destroyed. This result to cartilages from pressure is rendered more readily admissible when we consider the manner in which they are nourished. Cartilages are without blood-vessels and nerves of their own; those of the surrounding parts terminate at their surfaces; those of the synovial membrane at its junction with the edge of the cartilage; those of the bone at its point of union with the cartilage. It is not necessary for my purpose to show the precise way in which cartilage is formed, only that it is possessed of a low grade of vitality. In respect to its mode of nutrition, the cartilage resembles the cornea; and, as the effect of imperfect nutrition upon this portion of the eye has been fully established, I would direct attention to this point to illustrate the influence of like causes upon the cartilages. The justness of the comparison will be admitted if we keep in mind the similarity of their modes of receiving their nutritive supply. In experiments instituted by physiologists upon the inferior animals, it was shown that the cornea was readily affected with ulceration, when they were fed upon certain articles of food that did not furnish them with proper nourishment. I mention this fact to show how easily parts which are not supplied with blood-vessels take on the *ulcerative process*. In the case of the cartilage, the cause is mechanical which interferes with nutrition, but the result to the parts immediately acted upon is the same, viz.: deficient or interrupted nutrition by reason of uninterrupted pressure. That this result follows, is proved by the anatomical fact that the centre of the ulceration is always at the point of greatest pressure, as revealed on dissection in the cases presently to be cited.

There is yet another reason, founded upon the structure of a joint, why continued pressure with immobility should be attended with danger. The cartilage being an elastic substance, and affixed to the ends of two bones whose surfaces do not precisely correspond with each other, the greatest amount of pressure must come upon the centre of those portions in contact, gradually diminishing to the circumference; in this respect they are unlike two solid bodies, where the pressure would be equal upon all the parts in contact. The difficulty that would arise from this construction of the parts in a small articulating

surface like the hip-joint, where it is subject to great pressure, is somewhat obviated in this joint by a thickening of the cartilage around the upper surface of the acetabulum, in the form of a ring, which admits the extreme upper portion of the head of the femur to pass into it; thus presenting a larger surface to receive the pressure than would have existed had the cartilage been of an equal thickness throughout.

When a joint or limb is rendered immovable, its functional law is violated, and a corresponding penalty incurred, viz.: that following the loss of its accustomed exercise. A part suffers from this cause in proportion as its normal condition is one of greater or less motion; the joints and muscles must therefore suffer more in proportion than any other part of the body. This effect of rest has been noticed by authors as manifesting itself by ecchymosed spots upon a limb, as well as in a joint, rendered immobile; while its fellow, not kept motionless, was not so affected. Rest alone might not be sufficient to produce, in a particular case, very deleterious effects; but when we add to it continued pressure, and that, perhaps, applied to parts already somewhat enfeebled, we have influences that are potent for evil—influences that have wrought the destruction of many limbs, if not lives.

The first case that I shall give in support of the views I have presented is one reported by Dr. South, in his translation of Chelius' System of Surgery, as coming under his own observation.

"J. S., aged 25 years, a baker, came under my care in the year 1843. Three months after having typhus fever, four and a half years since, his right knee became weak, and he began to limp. At this time there was not any swelling of the joint; but during the following six months the knee swelled, and he was under medical treatment; an abscess formed below the knee-cap, and burst, subsequently, by two wounds below, and on the inside of the tubercle of the shin-bone. A discharge continued for four or five months; during which time he followed his business, and walked about a great deal. The wounds at last healed, but soon after swelling occurred below and around the knee-cap, and thirteen months since it suppurated, and continued discharging on the apex of the knee-cap till the beginning of April in this year. During the whole of this time he has walked, though not without pain, but has been unable to follow his business. The discharge having ceased, general swelling of the whole knee commenced, and he began to feel weakness on the sides of the joint. Being again crippled, he came into the hospital."

His condition grew worse, until his life was endangered. The doctor resolved to puncture, with a view to ankylosis.

"Aug. 19, 1843, made a puncture with an abscess lancet on the outside of the base of the knee-cap, where the skin was thinnest; blood and synovial fluid flowed out; the patient failed, and amputation was resorted to, saving the patient." "On examining the joint," he says, "the whole of the synovial membrane lining the capsular and extending over the other ligaments of the joint was found covered with a vascular, thick, soft, and granular substance.

"The cartilage on the *edge* of the patella was partially absorbed, as also that on the left articular cavity of the head of the tibia, in a semicircular form, and on both condyles of the femur it was partially removed; these corresponded to the granular substance on the synovial membrane, and a groove on the cartilage of the internal condyle answered to a remarkable slip of the granular substance, which crossed between and connected the capsular and crucial ligaments. There was not any pus in the joint."

The history of this case (most of the details of which I have omitted, because of its length,) corresponds quite perfectly with that of ordinary cases of morbus coxarius. The same pains, upon motion, the nocturnal exacerbations, the constitutional irritation, &c., &c.; it differs from the latter, however, in the entire absence of pus.

In this case we find the greatest amount of destruction of the cartilage precisely at those points exposed to constant pressure; the edges of the patella, the surface of the condyles, and the corresponding surfaces of the tibia, are the parts that suffered.

Have we, in this case, any disorganization within the capsule that might not have been effected by continued pressure and immobility, producing absorption of the cartilage, and a changed synovia in consequence? The condition of joints, where simple rest has been produced artificially, will throw some light upon this point.

Bonnet, in a work published in 1845,* gives the result of observations made by himself and Teissier, on the effects of prolonged immobility upon joints. He says, "I am about to demonstrate, anatomically, that long-continued immobility can produce severe diseases in the healthy joints." And then goes on to give the following results:

"1st. Effusion of blood and of serum in the articular cavities.

"2d. Injection of the synovial membranes, and the formation of false membranes.

* *Traité des Maladies des Articulations*, accompagné d'un Atlas avec 16 Planches, par A. BONNET, Professeur, etc. Paris et Lyon: 1845. Tome 1re, f. 9, et conseq.

"3d. Alteration of the cartilages.

"4th. Anchylosis."

He says, "I have not mentioned stiffness of the joints among the anatomical lesions which their immobility produces. This stiffness is frequently observed, and ought to be particularly considered as an effect of the alterations which the autopsy reveals in the cartilages and in the synovial membranes." He speaks of a local scorbutic affection, mentioned by some authors as produced by immobility. They have frequently noticed, he says, violet spots appearing upon immovable limbs. He gives M. Teissier credit for having first noted this effect of immobility upon the joints. The latter says, "I have almost invariably found in all the articular cavities of the diseased limb, even in those most remote from the solution of continuity, the secretion of synovia replaced by bloody serum, and even by liquid blood, almost without admixture. In one case, and one only, I have found clots of blood. This was in an old man, confined for six months for fracture of the neck of the femur."

Teissier says, also, that he has twice had occasion to observe considerable hydrarthrus of the knee, in two cases of fracture of the lower limb, in persons previously perfectly healthy. Under the second head, Bonnet writes, that in connection with effusions he should mention injection of the synovial membranes. M. Teissier, he says, has observed it in every case, without exception, which he has examined; that it exists particularly in those folds which the synovial membranes present normally, and which have a broken appearance. These folds become red and inflamed. "Sanguineous effusion and injection of the synovial membranes are the two first degrees of the effects produced by immobility.

"They are always found where the joints are materially altered, and are never wanting where false membranes exist. These last are observed but rarely as a consequence of immobility. In all the cases in which M. Teissier observed them, they were already supplied with vessels, and adhered to the cartilaginous surfaces.

"Their existence appeared to demonstrate that long-continued repose can produce in the joints lesions of an inflammatory nature." As to the third effect mentioned—viz., the alteration of the cartilages—he affirms, with Teissier, that "continued repose can produce serious alterations of the cartilages—such as redness, swelling, softening, erosion, and wasting away. The redness which is observed on the cartilages after immobility may be uniform or punctate. Where the cartilages are not eroded, it presents itself under the form of ecchy-

mosis more or less deep. On the contrary, where the cartilages are ulcerated, it is unequal, dotted."

In speaking of ulceration of the cartilages, he says that it proceeds from the free surface to the adhering surface.

"*Observation 1st.*—A man, 60 years old, entered the Hôtel Dieu of Lyons with oblique fracture of the middle of the femur. The limb was placed in Boyer's splint, and permanent extension made. After three months' treatment, the patient contracted diarrhœa, and died without having experienced any pain in the joint of the fractured limb.

"*Autopsy.*—The bones of the fracture are blunt and rounded, without the least trace of agglutination. A bundle of muscular fibres separates the ends of the bones. The soft parts are infiltrated with blood to a great extent, but do not present any sign of inflammation. The knee of the affected side contains a great quantity of effused blood. The cartilage of the internal articular fossa of the tibia, upon the posterior side, is destroyed to half its depth, in a circular form, having a diameter of one centimeter.

"The loss of substance is upon the free side, the depth unequal, and the circumference injected for some lines.

"The portion of cartilage, of the internal condyle of the femur, contiguous to the erosion, of which we have just spoken, is affected in all its thickness by a loss of substance, similar in its aspect and dimensions. The cartilage of the external articular fossa of the tibia is ulcerated behind in an irregular space, being about two centimeters in length. The loss of substance is of little depth, and unequal; the contexture of cartilage which supports this erosion is evidently softened and swollen; the other portions of the cartilage present an injected appearance, of a lively, uniform red. A similar redness is observed in the cartilage of the external condyle of the femur, in the whole extent corresponding to this last loss of substance. The diseased cartilages are detached from the bones with the greatest ease, but the femur has not undergone any alteration.

"The tibio-tarsal joint, notwithstanding its distance from the fracture, also presents an effusion of blood, a yellowish tint of the cartilages, which are also deprived of their polish, and an injection with tumefaction of the synovial membrane, which forms a fold between the tibia and the fibula."

"*Observation 2nd*, (communicated to Bonnet by Dr. Martin.)—A female 70 years of age, of impaired constitution, confined to the bed

68 days with fracture of the neck of the femur. She was kept in Desault's splint; died of bronchitis.

"*Autopsy*.—Knee quite immovable, and appeared fixed by the enlargement of the lateral ligament, lost in the midst of a cellular tissue, infiltrated with serum, and become compact.

"At the interior of the joint is found an effusion of blood, a little serous, amounting to about 30 grammes.

"The portion of synovial membrane which covers the intercondylian groove is very thick, puffed up, and as if ecchymosed. That which covers the crucial ligaments is equally infiltrated with blood. A vascular arborization, intermingled with spots or stains of ecchymosis, is delineated on the internal part of the external condyle of the femur, the cartilage of which has lost its polish at many points. The cartilage of the internal condyle is equally stripped of its polish in part, and generally softened, as well as the cartilaginous lining of the articular surfaces of the patella and tibia, which have taken a very decided yellow tint. The interarticular cartilages are infiltrated with blood. The cellulo-adipous bundles which sustain the posterior surface of the patellar ligament are swollen, and terminated by a fold of bloody bordering, which penetrates into the femoro-tibial articulation.

"The cartilage of the patella is in a great measure absorbed, and considerably softened, as we have already said, in that part which has escaped destruction.

"The bloody effusion shows itself in patches on the parts of the cartilage which are preserved.

"The bones do not present any trace of inflammation."

"*Observation 3d.*—Elizabeth B., aged 72 years, entered the Hôtel Dieu in July, 1839, to be treated for a fracture of the neck of the femur. The fractured limb was placed in extension, and kept in that position by the aid of compressive and immovable splint. After seven or eight weeks of fruitless treatment, as the patient suffered much, we were obliged to take off the splint, and abandon the fracture to the efforts of nature and to repose. This woman died after five months' confinement in bed, without any other symptom than extreme prostration.

"*Autopsy*.—We found the hip-joint healthy; an effusion of bloody serum in the knee; the cartilages yellow and rough in many points, and eroded in those of their parts which are naturally in contact in extension. The joint of the foot, examined with care, presented the same lesions, but in a less decided degree."

"*Observation 4th.*—Peter M., aged 85 years, of a very good con-

stitution, entered the Hôtel Dieu November, 1840, to be treated for an intracapsular fracture of the neck of the femur. He remained in the splint six months, but the fracture did not heal. At the end of this time he contracted a severe diarrhœa, and died in a few days.

"Autopsy.—We found absorption of the neck of the femur complete, and all consolidation wanting. The bony extremities of the knee were infiltrated with blood. The femoro-tibial joint contained a great quantity of bloody clots, black, very dull, and not fibrous.

"We found, also, some effused blood in the subsynovial cellular tissue, and even between the articular cartilages, and the bones which they cover; insomuch that these could be denuded with the greatest ease. As to the hip-joint, although there was an intracapsular fracture, it did not present any lesion."

Prof. Valentine Mott corroborates the statement, that the point of greatest destruction is also the point of greatest pressure, varying according to the position of the limb during its period of immobility.

Inquiries made of Professors Willard Parker, Van Buren, Markoe, and Krakowitzer * have been honored with the following replies:

NEW YORK, Sept. 3, 1860.

MY DEAR DOCTOR—On looking over my notes of dissections of diseased joints, I am sorry to find that the point about which you are most interested has not in any one of them been particularly noted, and I fear that you will find this to be the fact with most of the published cases, as it is a point to which the attention of observers has not been particularly directed. Since our conversation, however, I have seen the dissection of two knee-joints, amputated at the New York Hospital, which bear upon the point at issue. The first of these was a patient of Dr. Watson, who had been injured, I think, by a railroad contusion, some weeks before amputation. Suppuration and opening of the joint occurred, and during his confinement the limb was kept on an inclined plane at a slight angle. On examination after amputation, we found the usual condition of synovial infl. and suppuration, but precisely at the spots where the condyles of the femur pressed upon the surfaces of the head of tibia, there ulcerative action had gone on to so great an extent that the bone was exposed and already carious. This was the case both on the femoral and tibial surfaces of the articulation, and was the more striking, as in all the remaining portion of the joint, which had not been exposed to pressure, little or no ulcerative action had taken place.

* The very interesting letter of Dr. Krakowitzer has been unfortunately mislaid.
H. G. D.

The second case was one in which the knee was amputated by Dr. Parker, for long-standing disease, where the joint had been open by an incision some weeks before the operation. We found here more extensive general arthritic degeneration, but the ulcerative action was almost entirely confined to the points at which the bones had been so long in contact. At these points the disorganization had reached a point very nearly equal to that described in the first case, while the other parts of the articular surface showed thickening, vascularity, obliteration, superficial erosion, &c., but no deep or extensive ulceration.

With regard to the other matter we were talking of, viz., the situation of the pus in cases of diseased joints, my notes are more explicit. I find I have recorded eleven dissections of joints which had undergone suppuration, either in the course of chronic disease, or in consequence of injury, seven being cases of chronic disease and four of injury. In all these the dissection was conducted by first opening the cavity of the abscesses and noting how near they approached to the synovial membrane, and then by carefully opening the joint at some point where it was not covered by the abscesses, and carefully tracing the continuity of the synovial membrane. Thus examined, we found that in every case of chronic disease the abscess was external to the synovial sac of the joint, though generally approaching it in several points, so that only the thickened serous membrane intervened between the abscess and the synovial cavity. From these points of contact the abscesses were found to extend irregularly in all directions around the joint, forming numerous cavities and sinuses all communicating with each other, but not communicating with the cavity of the joint, except in one instance. In this case a narrow and tortuous track of communication was found between the extracapsular abscesses and the cavity of the joint, which cavity contained pus. This was the only instance in which, in this class of cases, we found any pus in the joints, or any communication with the abscesses, some of which were exceedingly extensive, and of very long standing. In this exceptional case the abscesses had existed for a very long time, were entirely extracapsular, and only communicated with the joint by the small track described.

In the four cases of disease originating from injury, an entirely different condition of things was found. In these the synovial sac was the seat of the suppurative action, and no extracapsular abscesses existed at all. In the cases where the abscess had not been evacuated before the dissection, the synovial sac was found distended with

pus, and in one instance it had given way, and the matter was beginning to burrow up the thigh. In the cases where the joint had been for some time open and discharging, the synovial sac was of course not distended, but it marked the limit of the suppurative action, though itself, as well as the cartilages, were much more extensively destroyed than in the cases of chronic disease. As these eleven cases of joint disease were not selected cases, but embraced all I had a chance of dissecting during the period of observation, some three or four years, I think they may be taken as indicating the general features of the anatomy of the disorder in its two phases, though of course it would not be safe to consider any pathological point as settled by so limited a number of observations.

Hoping to hear from you again on these subjects, which seem to me to have most important practical bearings,

I remain very truly yours,

T. M. MARKOE.

DEAR SIR—I have received your note of inquiry as to my observations in joints where the same points of surface have remained long in contact with the pressure of the muscles.

I beg leave to reply, that I have often seen in the knee-joint, after amputation, when the joint was opened, that where the surfaces had remained long in contact, the synovial membrane and cartilage were removed by absorption, and the bone at the same point dead for from an eighth to half an inch in depth.

In exsection of the knee-joint, on opening the cavity, I have found the same destruction to have occurred. The same pathological condition is observed at the hip-joint. Indeed, I regard it as established, that if the surfaces of the joints be allowed to remain long in a fixed position, the pressure from the muscles causes destruction of the substance making the wall of the joint. We see the same condition resulting in the joint, that happens when pressure is allowed upon the heel in the management of fracture—viz., ulceration and sloughing.

The more feeble the patient from scrofula or otherwise, the greater the danger from pressure.

You particularly called the attention of the profession to the above pathological state, in the *AMERICAN MONTHLY*, some five years ago, I think. You then stated the great importance in the treatment of hip disease, &c., of keeping the surfaces of the joints from pressure by the application of extending and counter-extending force, and referred to the great value of the India-rubber in applying the power.

The application of the splint in hip disease to establish extension and counter-extension, and at the same time permit the patient to walk and live in the air, as you have practiced for years, is a matter of great moment. You have laid the profession and the public under lasting obligation.

Yours truly,

WILLARD PARKER.

To H. G. DAVIS, M.D.

NEW YORK, *August 20th*, 1860.

DEAR DOCTOR—In thinking over the many cases of diseased joints which I have examined, after amputation and otherwise, my impression is strong that the greatest amount of disorganization has generally existed at those points where opposed articular surfaces have been habitually in contact with each other. This is, however, a general impression only, as until recently my attention has not been directed to this particular point of inquiry. A recent case in which I exsected the knee-joint in a young woman for chronic strumous synovitis, afforded strong and indubitable evidence on the point in question. In the centre of each of the articular depressions of the head of the tibia, I found a necrosed plate of bone, each about the size and thickness of a dime, lying loosely upon a bed of granulations. The articular surface was elsewhere profoundly altered, but except at these points, not beyond possibility of repair to the extent of ankylosis. I was gratified in recognizing the necrosis in this case, as it demonstrated the propriety of the operation of exsection, which was followed by an excellent result, the patient recovering with an exceedingly useful limb. The points of necrosis, you will have noticed, correspond with the localities upon the head of the tibia, with which the convexities of the two condyles of the femur had been in most constant contact.

My friend, Dr. Krakowitzer, informs me that in a recent successful case of exsection of the knee for similar disease, he encountered the same appearances at the same points.

I have heretofore believed on the evidence adduced by Bonnet, of Lyons, in his monograph upon diseases of the joints, that prolonged immobility of a joint was always followed by inflammatory action, and this has been confirmed by my own observation; but it is not improbable that the contact and pressure of opposed surfaces may play an important part in causing and aggravating the tendency to disorganization at the points of greatest pressure.

Truly, your friend,

DR. DAVIS.

WM. H. VAN BUREN.

In the observations quoted from Bonnet, there are two that are more full in their description upon points that are of consequence for illustrating the theory that simple rest or immobility alone is insufficient to affect a joint as disastrously as he believes.

These cases are those of intracapsular fracture of the head of the femur, when the patient had been confined for some time by treatment.

In these, ulceration had taken place, but was *limited to the points of pressure*. There is another fact of importance to which I call especial attention. In these two cases, *all the articulations below the seat of the fracture were disorganized, while the hip-joint, the locality of the injury, (the fracture being inside the capsule,) remains in a healthy, normal condition*. Why should not this, rendered more liable, one would suppose, by the injury, be affected like the others? All have been exposed, apparently, to the same influences.

But there is in reality an important difference of circumstances, and one which bears directly upon the question I am endeavoring to elucidate.

The head of the femur, being separated from the shaft, beyond the attachment of the muscles, remains isolated, and is beyond the reach of pressure from their contraction. It is in a state of *perfect rest*, while the other articulating surfaces of the confined limb, although at rest so far as motion is concerned, yet are liable to be approximated by the muscles, and consequently subject to pressure against each other equal to the contractile force of the muscles in action.

Where the cartilages remain free from pressure we find the joint healthy, while the cartilages subjected to continued pressure in the same limb and under the same circumstances otherwise, are extensively disorganized; the greatest amount of disorganization, too, being precisely at the point of greatest pressure. Are we not forced to infer that pressure performs an important part in this destructive process?

Now, what practical conclusions can we draw from the views advanced?

First.—That in all diseases exterior to the joint, when of sufficient gravity to render the same functionally immovable, and when continued for any length of time, the cartilages should be relieved from pressure by extension.

Secondly.—When the disease is within the capsular ligament, extension should be applied from the commencement, as the destruction of the cartilage will be in proportion to the activity of the inflammatory process.

Thirdly.—In immobility of the joints, from whatever cause, change of position of the articulating surfaces must be frequent, or extension applied. This extension should always be by means of a cord, pulley, and weight, or by some elastic material, *the result of both being that a certain amount of extension is kept up, whatever may be the position of the limb.*

This is never fully accomplished by fixing a limb in a given position, as by the ordinary splint, with its so-called extension. When extension is made by an elastic material the muscular fibre becomes wearied, the nervous influence is expended, and the bones come down until the extending power is exerted entirely upon the unyielding tissues. There is, practically, a radical distinction between fixing a limb as by the old mode of extension, and that by which an unremitting draft is kept up upon the muscles, and yet the limb is not so fixed but that the muscles may contract and thereby exhaust their nervous influence, and ultimately rest like any muscle wearied from exercise.

Previous to my introducing it, I have never seen elastic extension recommended, except by one author, and he advised it simply for the purpose of preventing surgical apparatus in fractures from loosening, and not for the reason for which I use it, viz., for overcoming muscular contraction.

It will not be amiss now to state what application of the principle of what I term "continued elastic extension," I have made, and with what results.

In ulcerations of the intervertebral cartilages and of the bodies of the vertebræ, I have devised apparatus that separates the diseased vertebræ from each other, and imposes the labor of sustaining the weight perpendicularly upon the lateral processes. Here it can rest until the disease stops, and the cavity is filled by bone. With this treatment restoration takes place with a good figure.

For morbus coxarius I have originated the treatment by appropriate splints, with which most of the members of the Academy are acquainted. The management of hip disease, based upon this principle, relieves entirely the suffering, puts the parts in the best condition for perfect restoration, and even if the disease is not checked, the limb is kept at full length and in a correct position.

Affections of the knee I treat in a similar manner and with the same success. I have devised an apparatus that will keep up extension upon this joint, and yet admit of flexion of the limb, the whole weighing but a few ounces.

The principle of the latter apparatus is also made applicable to the elbow and other joints.

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